

A COMPARATIVE ANALYSIS OF RIGID AND NON RIGID FIXATION IN MANDIBULAR FRACTURES: A PROSPECTIVE STUDY

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ABSTRACT

The aim of this prospective study was to compare the postoperative outcome in 80 mandibular fractures patients, treated by open reduction and internal fixation (ORIF) and intermaxillary fixation (IMF) at Oral and Maxillofacial Surgery Unit, Khyber College of Dentistry, Peshawar from 10th February 2006 to 9th February 2007.

The most common age group involved was 21-30 years and the common cause of fractures was road traffic accidents (38.75%), followed by fall (31.25%). Most common site of fractures was parasymphysis (41.24%) followed by angle (25%). Patients were divided in two treatment groups, having 40 patients in each group. Rigid internal fixation was assigned as group A and intermaxillary fixation as group B. Data regarding the study was evaluated and reviewed. Two patient groups were not significantly different in relation to postoperative normal occlusion ($p=0.45$), malocclusion ($p=0.45$), mal-union ($p=0.45$), delayed union ($p=0.07$), non union, infection ($p=0.28$) and sensory disturbances ($p=0.07$). The result was significant in relation to mouth opening ($p=0.0001$). This study will help us regarding the measures to be taken in prevention of postoperative complications.

Key words: Mandibular fracture, rigid internal fixation, intermaxillary fixation, postoperative complications.

INTRODUCTION

Mandible occupies a very prominent and vulnerable position on the face and is a favored target of intentional and unintentional impact.¹ It is a mobile bone and plays a vital role in mastication, speech and deglutition². Mandibular fractures may occur alone or in combination with other facial bone fractures.^{1,2} Fracture sites depend upon the mechanism of injury, magnitude and direction of impact force, prominence of mandible and anatomy of site.³

The common etiological factors of mandibular fractures are road traffic accidents (RTA), falls, firearm injuries (FAI), interpersonal violence, sports injuries and industrial accidents.⁴ These etiological factors

depends on the geographic condition, socioeconomic status, cultural characteristics and era.⁵ The highest incidence is noted in 21-30 years with a male to female ratio 3:1.⁶ The most commonly fractured site is the angle followed by body and parasymphysis.⁷

Whenever the mandible is fractured, treatment must be directed to the restoration of form and function of stomatognathic system.⁸ Current established methods in the management of mandibular fractures include conservative treatment with intermaxillary fixation (IMF) by dental wiring, Arch bars and Gunning splints, open reduction and intraosseous wiring and IMF and open reduction and rigid internal fixation by miniplates, non-compression plates, compression plates and lag screws.^{9,10} Previously, most of the mandibular

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fractures were treated by closed reduction and fixation. Current advancements in the field of surgery, anesthesia and armamentarium have made ORIF with plating system integral to the management of mandibular fractures. The popularity of ORIF is attributed to its putative advantages; earlier return to function, better patient acceptance and outcomes that are less influenced by patient compliance.¹¹ ORIF incorporates several technical advantages that facilitate the management of complex mandibular fractures. Besides giving a more precise reduction, the ORIF provides predictable healing and better patient acceptance. The early return of function afforded by ORIF is believed to promote the patient oral health related quality of life and minimize any masticatory disability resulting from prolonged immobilization of jaws.¹² Scientific evidences lack to corroborate the experimental advantages of ORIF approach in terms of important outcomes such as morbidity, quality of life and cost.¹³

The proliferation of bone plates system does not mean that ORIF is superior to conventional IMF. The role of IMF in the management of mandibular fractures can not be underestimated. More fractures are treated with IMF with excellent results regarding the precise anatomic reduction and economy. IMF is considered cheap, time honored and versatile.^{12, 13} In developing countries, IMF is still the current method of treatment.^{11, 12, 13}

METHODOLOGY

This study was carried out at Oral and Dental Hospital, Khyber College of Dentistry, Peshawar, from 10th February 2006 to 9th February 2007. Eighty patients with mandibular fractures associated with no other facial fracture were selected. Condylar fractures, pathological fractures and patients having any severe systemic disease were excluded from the study. They were divided into two treatment groups (group A and group B), each having 40 patients. Patients who received rigid internal fixation were put in group A and those treated with IMF in group B.

With the consent of the patient, all the necessary information about the variables of the study written in preformed proforma were collected by history taking and meticulous clinical examination. Preoperative infection, occlusion, mouth opening and sensory disturbances were assessed and evaluated by clinical exami-

nation. Orthopantomogram (OPG) was the standard radiograph and when required were supplemented by lateral oblique view, postero-anterior (PA) view, occlusal view and periapical view.

Before doing the procedure, a written informed consent was taken from all those patients included in the study by explaining the risks and benefits associated with procedures. Patients were followed for normal union, infection, non union, malunion, malocclusion, mouth opening and 5th nerve disturbance. The data obtained was evaluated and analyzed by applying descriptive statistics, chi-square test and student's t-test. The level of significance was set at $p < 0.05$. SPSS version.10 was used for statistical analysis.

RESULTS

The most common age group involved was 21-30 years with a mean value of 24.9 ± 15.4 years. Regarding gender distribution most patients were male with a male to female ratio of 5.6:1. Table 1.

Majority of the patients came under the category of road traffic accidents ($n = 37$, 38.75%), followed by fall ($n = 25$, 31.25%), while the least involved group was sporting injuries. Fig 1.

The most common site of mandibular fractures was parasymphysis (41.2 %) followed by angle (25 %) and body (18.7 %). Fig 2.

Six patients experienced infection in group A and 3 patients in group B. However, the difference is not significant statistically ($p = 0.288$). Normal occlusion occurred in 35 patients and 37 patients in group A and group B respectively ($p = 0.45$). Malocclusion was encountered in 5 and 3 patients in group A and group B respectively ($p = 0.45$). The difference is not significant statistically.

Mal-union occurred in 5 patients in group A and 3 in group B ($p = 0.45$). Delayed union encountered in 3 patients in group B only ($p = 0.077$). None of patient had non union in either group. Statistically the difference is not significant.

Sensory disturbances, due to surgical intervention, occurred in 3 patients in group A only ($p = 0.077$). Statistically this figure is not significant. At the end of treatment, mouth opening in group A was 42.1 ± 3.36

TABLE 1: AGE AND GENDER DISTRIBUTION OF PATIENTS
(n=80)

Age (in years)	Gender		Total	Percentage
	Male	Female		
1-10	10	2	12	15
11-20	13	4	17	21.5
21-30	29	1	30	37.5
31-40	4	2	6	7.5
41-50	6	2	8	10
51-60	5	1	6	7.5
61-70	1	0	1	1.25
Total	68	12	80	100

Fig 1: Etiology of fractures (n=80)

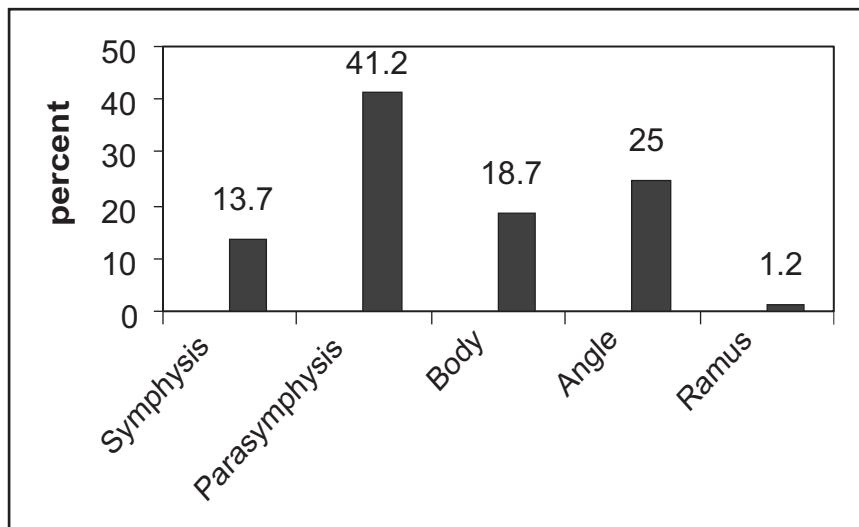
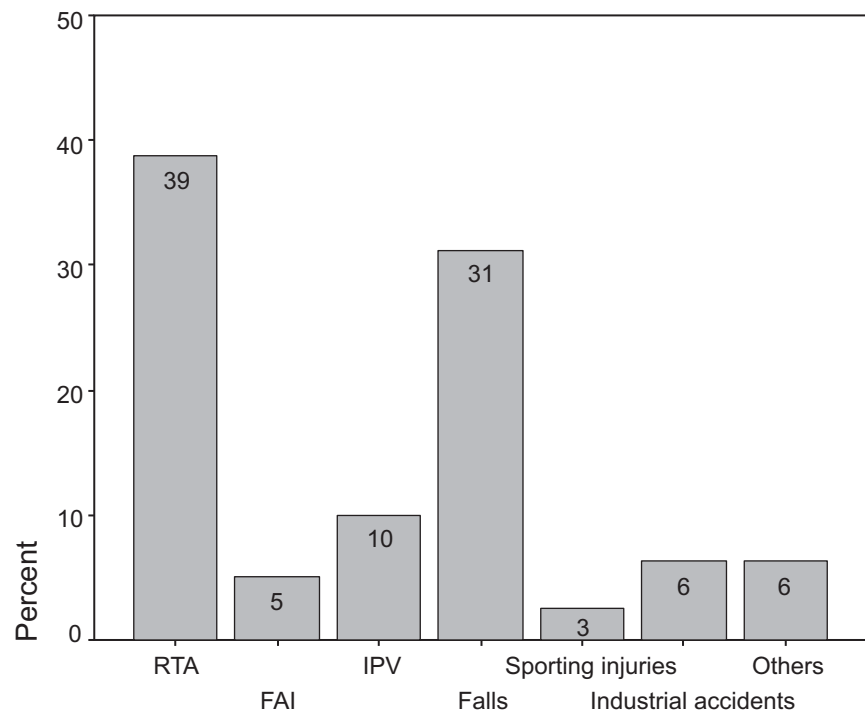


Fig 2: Site distribution of mandibular fractures (n=80)

TABLE 2: COMPARISON OF POSTOPERATIVE RESULTS

S. No	Study variables	Group A n = 40	Group B n = 40	Calculated χ^2 and t-values	DF	P-value
1	Infection	6 (15%)	3 (7.5%)	1.126	1	0.288
2	Normal occlusion	35 (87.5%)	37 (92.5%)	0.55	1	0.456
3	Malocclusion	5 (12.5%)	3 (7.5%)	0.55	1	0.45
4	Mal-union	5 (12.5%)	3 (7.5%)	0.55	1	0.456
5	Delayed union	0 (0%)	3 (7.5%)	3.11	1	0.077
6	Non-union	0 (0%)	0 (0%)	—	—	—
7	Sensory disturbances	3 (7.5%)	0 (0%)	3.11	1	0.077
8	Mouth opening	42.1 $\pm$ 3.36mm	27.2 $\pm$ 4.43mm	16.94	39	0.0001

mm and 27.2 $\pm$ 4.43 mm in group B. Statistically the difference is highly significant (p=0.0001). Table 2.

DISCUSSION

Restoration of physical integrity and earliest possible functional life with minimum morbidity is the ultimate goal of maxillofacial surgeons for management of mandibular fractures.

During the present study the age ranged from 5-70 years with the mean age 24.92 $\pm$ 15.54 years. The most common age group was 21-30 years (37.5 %) followed by 11-20 years (21.25 %). Regarding gender distribution 85% patients were male (n=68) and 15% female (n=12). The male to female ratio was being 5.6:1. A study conducted at Punjab Dental Hospital Lahore in 2003 by Abbas I and coworkers had reported similar results about the age and gender distribution in mandibular fractures.² The studies of Hussain S (2005)¹², Hussain S et al (2003)¹³, Sawhney CP (1988)¹⁴, Khan AA (1988)¹⁵ and Wong KH (2000)¹⁶ have reported similar findings about the age and gender distribution in mandibular fractures.

In the present study RTA is the leading cause, followed by fall from height. The findings of RTA, as the leading cause of mandibular fractures, followed by fall from height, is consistent with the previous studies^{1,2,12,13,15}. The most common site of mandibular fracture was the parasymphysis accounting for 41.2% followed by the angle (25%). Similar results were given by Renton TF et al (1996)¹⁷ and Moreno JC et al (2000)¹⁸, where parasymphysis predominated other sites of mandible, while Adi Met al¹⁹ reported a higher percentages of body and condylar fractures resulting from RTA.

The current study showed infection being the common complication in both groups, in total it was 11.5% (n=9), it was 15% in group A and 7.5% in group B. Similar results have been reported by Moreno JC et al¹⁸ (12.5%), Renton TF et al¹⁷ (15%) and Dodson TB et al (1990)²⁰ (17.9%). The higher number of infection in rigid fixation may be attributed to the contamination of fracture site from the intra-oral or extra-oral incisions, pattern of fracture, technical errors, lack of prophylactic antibiotics and non compliance of patients^{12,21}. For non rigid fixation this study shows 7.5% infection rate. This figure coincides with the previous studies in the past^{17,20}. The low rate of infection in the non rigid group may be due the fact that less severe fractures are treated by conservative means which does not require exposure of fracture site and, thus, minimum chances of contamination.

The second most common complication noted was post surgical malocclusion, occurred in 8% of total cases. The presence of post surgical malocclusion depends on patient's dental status, the number of fractures, type of fracture, the degree of displacement of fragments, type of reduction, fixation and immobilization. In group A malocclusion was noted in 12.5% patients (n=5) and in group B 7.5% (n=3). Iizuka T and Lindqvist C²², and Cawood JI²³ had reported similar malocclusion rate in rigid fixation, which correlates with the present study. The reported rate of malocclusion in conventional method was less (7.3%), which coincides with the previous studies^{13,17,20}. The low percentage of malocclusion in group B may be due the fact that IMF is done for a longer duration which maintain the teeth in proper occlusal relationship. Moreover, non displaced and

less severe fractures are treated by conventional methods.

In this study 12.5% (n=5) malunion is encountered in group A and 7.5% (n=3) in group B. Hussain S (2005)¹² and Hussain Set al (2003)¹³ reported no case of malunion in their studies. In the study of Dodson TB and coworkers²⁰ not a single case of malunion occurred in plating group while 1.9% encountered in IMF group. Valentino J et al²⁴ reported 4.1% malunion in rigid fixation while Khan AA¹⁵ reported 4.5% malunion in patients treated by IMF. The higher percentage of malunion in group A is due the fact that more severe fractures were treated by rigid fixation followed by early release of IMF in these patients. The malunion encountered in this study in both groups was minor in nature and required no surgical intervention.

Delayed union was defined as excessive mobility of the fracture site after 4-6 weeks of treatment. There was not a single case of delayed union in group A, while 7.5% (n=3) delayed union occurred in group B. Similar results regarding the delayed union had been reported in the literature^{10, 12, 20, 22}. The high percentage of delayed union, in non rigid fixation, is due the fact that non rigid fixation does not guarantee the mechanical rest in the fracture region that is necessary for the healing of bone. Rigid fixation with bone plates precludes interfragmentary motion, an essential pre-requisite for healing safe from infection. Fortunately, none of the patient in this study required further surgical intervention and progressed to normal union with only prolonging the period of IMF for 2 weeks.

Non union means that the fracture is, not only, not united but will not unite on its own. The radiographs will reveal rounding off and sclerosis of bone ends called eburnation. Fortunately, none of our patient faced this complication. This finding is in matching with the studies of Abbas I², Peled M⁹, Hussain S¹², Khan AA¹⁵, Dodson TB and colleagues²⁰ and Smith WP²⁵.

Sensory disturbances were recorded as the disturbances of inferior alveolar nerve, mental nerve and lingual nerve according to patient complaint. Sensory disturbances of two mental nerves and one inferior alveolar nerve were recorded in group A. It was due to elevation of flap and inadvertent placement of screws in the course of nerves. Schon R et al²⁶ reported 3% and

Jaques B et al¹⁰ 1.45% sensory disturbances in mental nerve while Cabrini Gabrielli MA et al²⁷ reported 0.89% paraesthesia in I.D. nerve after applying rigid fixation, while Iizuka T and Lindqvist C²² reported a higher number of sensory disturbances in rigid fixation. Brown JS et al²⁸ have reported mental paraesthesia in four patients (13.3%) of IMF group and five patients (16.6%) in plated group. This percentage is comparatively high from the present study and from those reported in literature^{10,17}.

During open reduction mental, inferior alveolar and marginal mandibular branches of facial nerve are at high risk of injury. These complications can be avoided by careful reflection of flaps and placement of screws.

At the end of the treatment mouth opening was measured for both treatment groups. It is the distance between the incisal edges of upper and lower incisors teeth when the mouth is maximally opened. In this study the mean mouth opening was 42.1 ± 3.36 mm and 27.2 ± 4.43 mm for group A and Group B respectively. The results of Newman L (1998)²⁹ 44 ± 2 mm for rigid fixation and 28 ± 2 mm for non rigid fixation coincides with the present study. Al-Belasy FA (2005)³⁰ noted a significantly greater degree of mouth opening in patients having early mobilization following treatment. Gabrielli MAC et al²⁷ observed mean mouth opening 42.08mm in patients treated by rigid fixation. This trismus may be probably due to the prolonged immobilization of the mandible in intermaxillary fixation resulting in weakening of the muscles of mastication.³¹ Trismus in group B was relieved in a week to ten days by advising a wooden stick exercise to these patients.

CONCLUSION

This study was carried out to investigate different treatment modalities of mandibular fractures. It is noted that open reduction and internal fixation provides optimal stability for healing and allow immediate function of stomatognathic system but high complications rate. Regarding postoperative infection, malocclusion, mal-union, delayed union, non union and sensory disturbances, statistically, the difference is not significant between the two treatment groups. However, the difference is highly significant regarding postoperative mouth opening. It was also noted that rigid internal fixation by plates and screws provide

precise reduction, increased comfort and safety of patients and early restoration of functional life in more severe cases of mandibular fractures. However, IMF is a useful method and is still practiced successfully in developing countries. Further, more controlled prospective studies are necessary to compare the two treatment modalities to establish clinical protocols.

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